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Abstract

MONOCARBIDES AS REACTOR FUELS

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Basic studies of the preparation of U-C and (UPu)-C by the carbothermic reduction of UO_2 and $(UPu)O_2$ in vacuum have led to the development of alternative processes for the preparation of carbides. One process, which is carried out in an atmosphere of flowing gas such as argon, appears to be particularly suited to continuous operation to give a product which can be fabricated into various fuel forms by a variety of techniques.

It is now possible to produce fuel pellets of high density by sintering carbide powders in argon or in vacuum at temperatures close to 1500°C provided that the powders are sufficiently fine and are prevented from reacting with moisture or oxygen. Accurate control of the composition of the final product can be achieved by careful control of the feed materials, by blending powders of various carbon contents or by hydrogen reduction of the powders or the pellets. In addition, high density rods of carefully controlled composition have been prepared by skull melting and by centrifugal casting and the effects on the final product, of changes in the melting technique and the nature of the feed material for melting, have been studied. These investigations have been supplemented by work on vibratory compaction, gas pressure bonding and electron beam melting

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techniques. The suitability of these processes for the preparation of fuel for particular application is discussed and information on changes in plutonium content of (UPu)-C materials during fabrication is presented.

The potential of carbides as reactor fuels is considered in the light of recent measurements of physical and chemical properties, phase equilibrium determinations and the known irradiation behaviour. Possible future developments leading to improved irradiation behaviour are suggested and some information on the preparation and properties of cemented and bonded carbides, and carbides containing strengthening carbides in solid solution is presented.